

ENVIRONMENTAL RESTORATION FIVE-YEAR REVIEW

ELMENDORF AIR FORCE BASE, ALASKA

1.0 INTRODUCTION

1.1 Purpose. The purpose of this five-year review is to ensure that remedial actions selected in the Records of Decision (RODs) for Operable Units (OUs) 1 through 6 at Elmendorf Air Force Base (AFB) remain protective of public health and the environment and are functioning as designed. The start of construction of the OU2 Interim Remedial Action (IRA) (August 5, 1993) triggered this periodic (five-year) review requirement. The scope of this review covers selected remedies at all of the OUs and is considered a Type Ia review in accordance with the Environmental Protection Agency (EPA) OSWER Directive 9355.7-02A (July 26, 1994).

1.2 Authority Statement. The United States Air Force (USAF) has conducted this review pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC 9621(c), the National Contingency Plan (NCP) - 40 CFR 300.400(f)(4)(ii), Executive Order 12580 (January 23, 1987), and Section 19.1 of the Federal Facility Agreement (FFA) for Elmendorf dated September 1991. This document is consistent with these EPA guidance documents: OSWER Directive 9355.7-02 (May 23, 1991) as supplemented by OSWER Directives 9355.7-02A (July 26, 1994) and 9355.7-03A (December 21, 1995). Consistent with the FFA, the project managers for the EPA and the State of Alaska Department of Environmental Conservation (ADEC) have participated in this review. This review is limited to only those sites being remediated under CERCLA authority.

1.3 Review Procedure. In conducting this five-year review the project team reviewed and evaluated the ROD requirements, the work that has been done to satisfy those requirements, current and past monitoring data, the current status of the remedies and the physical condition of the sites. This included visits to each OU where action has been performed or is in progress. Review of most of the OUs was done concurrent with preparation of OU Remedial Action Reports. Those reports contain more details of the remedial actions performed for each OU, monitoring data, and evaluation of data trends and progress toward cleanup goals. The five-year review report was then drafted and subjected to a series of peer and public reviews.

1.4 Community Involvement. The community was given several opportunities to have input to and review/comment on the draft five-year review. The AF/ADEC/EPA project team briefed the Elmendorf Restoration Board (RAB) on the draft five-year review document and its findings at a meeting held on May 6, 1998. The draft document was sent to all RAB members and placed in two local information repositories for community members to review and comment. The general public was notified of this opportunity through a fact sheet mailed in early August 1998. The only public comments received were from two RAB members and those comments were addressed in this final document. The final document and a fact sheet describing the findings of the review will be placed in the information repositories.

1.5 Installation Description. Elmendorf AFB is composed of 13,103 acres and is within the Municipality of Anchorage, Alaska. It is bound on the west and north by the Knik Arm of Cook Inlet and on the east by the Fort Richardson Army installation. Immediately to the south of Elmendorf AFB lies urban development within the Municipality of Anchorage.

Base operations since the mid-1940s have generated varying quantities of hazardous and non-hazardous wastes from industrial and airfield operations, fire training and fuels management. In August 1990, Elmendorf AFB was placed on the National Priorities List (NPL), bringing it under the federal facility provisions of CERCLA Section 120.

To date, the USAF has identified 81 sources of contamination from historic operations which occurred prior to 1984. These sources have been grouped into three major divisions: CERCLA sources, state program sources, and other program sources.

Thirty-seven of the 81 source areas are designated as CERCLA sources. These sources have been grouped into six operable units (OUs) depicted in Figure 1 and remedial activities are being conducted under the FFA. Thirty-nine source areas have been designated as state program sources and remedial activities are being performed under the State-Elmendorf Environmental Restoration Agreement (SERA), which was signed in October 1992. The SERA source areas have been grouped into construction debris and rubble disposal sites; petroleum, oil and lubricant (POL) spills; and underground storage tanks (USTs). The remaining five source areas were initially identified as historical sources but on further investigation were determined to be Resource, Conservation and Recovery Act (RCRA) sources and were transferred to Elmendorf's Environmental Compliance Section.

In 1995, a multi-step strategy was developed to identify areas of concern (AOCs), which may have been overlooked during the original 1983 record search and subsequent remedial investigation. This strategy consists of reviewing historical aerial photographs, reviewing historic records (base maps/real estate records) and existing Environmental Restoration Program (ERP) data to identify land use changes and where disposal or storage of hazardous materials or petroleum products may have occurred. Currently, 15 AOCs have been identified, five of which are old abandoned pipelines and two of which were transferred from the Environmental Quality program. Limited soil sampling is under way at the remaining eight AOCs to validate if a release has occurred. If sampling validates contamination exists, the AOC(s) will be addressed under the appropriate CERCLA or state program.

1.6 Physical Site Characteristics

1.6.1 Geology. Glacial and related deposits including terminal moraines, ground moraines, and glacial outwash plains dominate regional landforms on Elmendorf AFB and in the Anchorage area. The most distinctive landform at Elmendorf AFB is the Elmendorf Moraine, a southwest-northeast trending terminal moraine. The moraine consists of horizontally and vertically discontinuous, unconsolidated glacial till with poorly sorted boulders, gravel, sand and silt deposits. Finer-grained clay lens deposits are found throughout the moraine and may result in zones of perched groundwater. The southern boundary of the moraine is visible as a rising bluff line along the north side of Elmendorf's east-west runway. Moraine elevations range from 200 to 300 feet above mean sea level.

Landform features formed under or adjacent to glacial ice can be seen north of the Elmendorf Moraine in the form of drumlins, eskers, kame terraces, and kettle lakes. Elevations in this area range from 125 to 210 feet and gently slope to the east.

South of the Elmendorf Moraine lies the glacial outwash plain alluvium. The alluvium deposits were formed by a series of coalescing streams resulting from glacial melt water. These outwash plain deposits consist of unconsolidated fine- to medium-grained, poorly sorted sand and gravel. Elevations range from 100 to 225 feet above mean sea level. Relief is mostly flat, and slopes gently to the south-southwest. Most of the developed areas on the base are built in the outwash plain alluvium and over 90 percent of the contaminated sites are located in this area.

Underlying glacial moraine and outwash deposits are the shallow marine deposits of the Bootlegger Cove formation. The Bootlegger Cove formation is a fine-grained glacioestuarine deposit consisting of silt and clay. Depth to the Bootlegger Cove formation ranges from 1 to 60 feet below ground surface near the moraine and from 75 to 100 feet below ground surface throughout the outwash plain. Overall, the formation is thought to be at least 125 feet thick and may be more than 250 feet thick in certain locations.

1.6.2 Groundwater. Two principal groundwater aquifers have been identified in the glacial outwash plain alluvium and on the Elmendorf Moraine. These aquifers include a shallow unconfined aquifer (shallow aquifer), and a deeper confined aquifer. The Bootlegger Cove formation acts as the confining layer between the shallow and deep aquifers. In general, groundwater flow direction in the shallow aquifer matches closely that of the surface topography. Subsurface flow is to the northwest along the north limb of the moraine, and to the southeast along the south limb. The groundwater divide coincides with the crest of the moraine. The shallow aquifer on Elmendorf is not used for drinking water.

The deeper confined aquifer is found under the entire base and generally flows in a westerly direction from the Chugach Mountains toward Knik Arm. Groundwater from the deeper confined aquifer at Elmendorf AFB serves only as a standby drinking water supply when surface water supplies cannot meet the demand. However, the municipal area bordering Elmendorf AFB uses groundwater for various services including industrial, commercial, domestic, and public supply. Based upon groundwater monitoring data, there is contamination in portions of the shallow aquifer on-site. However, the deeper confined aquifer has not been impacted by any contaminants from sources on Elmendorf AFB. The Bootlegger Cove formation seems an effective barrier between the aquifers; there is no evidence they are interconnected.

1.6.3 Surface Water. Elmendorf AFB has four major drainage basins and a number of natural and man-made lakes and ponds. The major drainage systems include Ship Creek, Six-Mile Creek, EOD Creek, and Cherry Hill Ditch. Ship Creek is the largest surface water drainage system on Elmendorf AFB. It originates in the Chugach Mountains to the east, runs along Elmendorf's southern boundary and empties into the Knik Arm. The upper Ship Creek basin is an important recharge area for the deeper confined aquifer and provides approximately one quarter of total recharge to the system. Six-Mile Creek and EOD Creek are located north of the Elmendorf Moraine. Six-Mile Creek originates as springs located near the Elmendorf AFB and Fort Richardson boundary. Cherry Hill Ditch is the major stormwater drainage system for the

main base area south of the Elmendorf Moraine. Elmendorf AFB has 12 natural and manmade lakes and ponds varying from one acre to 123 acres in size. The vast majority of these water bodies are located north of the Elmendorf Moraine. There is no evidence of surface water contamination from sources on Elmendorf AFB.

2.0 OPERABLE UNIT DESCRIPTIONS AND REMEDIAL ACTION OBJECTIVES

2.1 Operable Unit 1. OU1 is located in the eastern portion of the base, next to the Davis Highway and immediately north of Ship Creek. OU1 is over 60 acres in size. It consists of five general waste disposal areas where various types of material were disposed of, including general refuse, scrap metal, used chemicals, construction debris, and drums of asphalt.

The OU1 ROD (USAF, 1994a) was signed in September 1994 and focused on groundwater. The major components of the selected remedy include:

- Monitor groundwater for five years, or until the groundwater no longer poses an unacceptable health risk.
- Implement institutional controls which include:
 - Develop a site map showing the areas currently and potentially impacted by groundwater contaminants.
 - Restrict land use and designate the area for outdoor/recreational use.
 - Enforce base policy prohibiting installation of groundwater wells into the shallow aquifer.

2.2 Operable Unit 2. This OU contains two areas where USTs had been constructed; ST20, located in the central portion of the base and ST41, located in the western part. ST20 is the former site of a 338,000-gallon UST used to store bunker C fuel oil for the original base power plant. After the power plant was shut down, the tank was used to store waste oils, used solvents, and other wastes generated by industrial shops. The tank was cleaned and demolished in 1990. ST41 is the former site of 4 one-million gallon USTs.

An interim ROD (USAF, 1992) for the groundwater contamination at ST41 was signed in September 1992. As a result of this ROD, a free product and dissolved phase recovery treatment system was installed at ST41. Pursuant to the IRA ROD, a fuel product and groundwater recovery/treatment system was designed and constructed in 1993. The system was designed to remove product from the groundwater table and to decrease off-site migration of contaminants from groundwater seeps on the north and south sides of ST41. Floating fuel product has been measured and removed weekly since 1993. During operations from 1993, the recovery and treatment system has performed as designed; however, far less fuel product was recovered and treated than originally anticipated. Since February 1997, no recoverable quantities of fuel product have been observed.

During the operation of the groundwater treatment system at ST41, far less fuel product was recovered than predicted. When the underground storage tanks and associated pipelines were removed in 1996, it was discovered that the tanks and pipeline system had not leaked as assumed in the original conceptual site model. The fuel at the groundwater seeps were found to be coming from a woodstave pipe which drained the valve pits at each tank. In addition, during the evaluation of the ST41 treatment system (USAF, 1997a), a complete review of historical spills was completed. This review revealed that the RI/FS and ROD had erroneously reported two catastrophic spills since the mid 1970's which could not be confirmed through a complete search of base records. It is believed that these two catastrophic spills (one spill was reported to be several million gallons and the other several hundred thousand gallons) never occurred. With this new information from the 1996 tank removal project and the evaluation of ST41 treatment system report, a new conceptual site model was developed which illustrates that there is less fuel to recover than what was originally anticipated and explains why large quantities of fuel have not been recovered.

The OU2 ROD (USAF, 1995b) was signed in May 1995 and it focused on removal of contaminant sources and continued groundwater cleanup at ST41. Due to minimal soil contamination at ST20, this site was designated as no further action (NFA) in this ROD. The major components of the selected remedy at ST41 include:

- Continue operation of the free-product recovery system until:
 - All technically-practicable free product has been recovered to mitigate the continuing source of contamination,
 - It can be determined that State of Alaska Water Quality Criteria are being met at groundwater seeps, and
 - It can be shown that natural attenuation will be protective of the wetlands in the area.
- Continue long-term monitoring (LTM) of the groundwater.
- Maintain institutional controls that restrict access to groundwater and contaminated surface and subsurface soils.
- Clean and abandon in-place 4 one-million gallon USTs. Excavate, remove and dispose/recycle the piping system.
- Remove contaminated soil that contains leachable concentrations of fuel-related contaminants and treat off-site by low-level thermal treatment.

A contingent alternative (groundwater pump-and-treat) was selected and will be implemented if LTM indicates natural attenuation and the free-product recovery system are not providing adequate protection to human health and the environment.

2.3 Operable Unit 3. OU3 is located in the southwestern portion of Elmendorf AFB. This OU consists of three sources and one receptor area. At SD16, waste solvents from Building 31-260 were disposed of in open trenches. At SD31, floor drains from Building 32-060 (Hangar 5) were discharged into dry wells and septic systems. The septic system and dry wells at SD31 were excavated in 1993. SS21 is an area where transformers containing polychlorinated biphenyls (PCBs) were stored. SD52, Cherry Hill Ditch, is a receptor for the stormwater from a major portion of the base. In 1994, low levels of PCBs were capped in the bottom of Cherry Hill Ditch (SD52) and a stormwater diversion project was completed at this receptor area. SD16, SD31, and SD52 were determined to be NFA sources in the OU3 ROD (USAF, 1997g). The OU3 ROD was signed in January 1997 and the selected remedy focused on the PCB soil contamination at SS21. Major components of the cleanup action at SS21 include:

- A chain-link fence will be temporarily installed to restrict access to the area until the PCB-contaminated soil can be excavated and disposed of off-site.
- All soil with PCB concentrations in excess of 5 parts per million (ppm) will be excavated and shipped to an EPA-approved disposal facility in the Lower 48.
- After cleanup is complete, SS21 will be available for unrestricted land use. However, as required by other RODs, institutional controls that prohibit the use of the shallow aquifer in the outwash plain will remain in effect for groundwater in this OU.

2.4 Operable Unit 4. OU4 consists of 10 source areas which include floor drains in eight maintenance facilities (SD24 through SD30 and SS18), a fire training area (FT23), and an asphalt drum storage and processing area (SS10). Eight of the ten source areas in OU4 are located north of the east-west runway and south of the Elmendorf Moraine. The remaining two source areas (SD30 and SS18) are located south of the east-west runway, near 2nd Street between OUs 3 and 5. Due to minimal soil contamination at SD26, SD27, SD30, and SS18, these sites have been designated as NFA sources and decision documents were signed in May 1993. During the fall of 1993 and summer of 1994, a response action at SS10 removed both liquid asphalt and asphalt-containing soils left over from former asphalt batch operations. Over 100,000 gallons of asphalt were recovered and recycled for reuse on base.

The OU4 ROD (USAF, 1995a) was signed in October 1995, and the major components of the selected remedy include:

- Intrinsic remediation¹ will be relied upon to attain cleanup levels in the contaminated shallow aquifer. Groundwater will be monitored semiannually to evaluate contaminant migration and timely reduction of contaminant concentrations.
- Until cleanup goals are achieved, institutional controls that prohibit the use of the shallow aquifer will ensure that people will not be exposed to contaminated groundwater.

¹ RODs signed prior to 1998 used the terms “natural attenuation” or “intrinsic remediation” for what is now known as “monitored natural attenuation”.

- In-situ bioventing will be used to treat deep soils (greater than 5 feet in depth) potentially contributing to contaminants in groundwater at FT23, SD25, and SS10.
- Both shallow (less than 5 feet in depth) and deep soils will be monitored biannually (every 24 months) to evaluate contaminate migration and timely reduction of contaminant concentrations by bioventing and intrinsic remediation.

2.5 Operable Unit 5. OU5 is located along the southern boundary of Elmendorf AFB adjacent to Ship Creek. OU5 covers an area over 7,000 feet long and over 1,200 feet wide. Approximately 90 percent of the shallow aquifer flowing through Elmendorf AFB is thought to flow into OU5. Upgradient sources from OU5 (OUs 1, 2, 4 and several SERA sites) are the source of some of the groundwater contamination in OU5. Regardless of the source, groundwater contamination is being treated through OU5 remedial actions (including the ST37 wetland system). Due to minimal soil contamination at ST38, SS42, SD40, ST46, and SS53, these sites have been designated as NFA sources and decision documents were signed in August 1994.

The OU5 ROD (USAF, 1995d) was signed in February 1995, and the major components of the selected remedy include:

- Approximately 3,000 cubic yards of soil contaminated with fuel at ST37 will be excavated and treated at an on-base treatment facility.
- Natural attenuation² will be relied upon to attain cleanup levels in the contaminated shallow aquifer and surface water other than seep water at ST37. Groundwater, seep water, and surface water will be included in the basewide monitoring program.
- Contaminated seep water in the western and middle portions of OU5 (ST37) will be passively drained using horizontally inserted extraction wells in the bluff. Contaminated seep water will flow to a constructed wetland, at the location of the “snowmelt” pond. A layer of gravel will be placed over the sediments in the “snowmelt” pond to isolate low levels of PCB contamination.
- Until cleanup goals are achieved, institutional controls that prohibit the use of the shallow aquifer will ensure that people will not be exposed to contaminated groundwater.

2.6 Operable Unit 6. OU6 consists of three source areas located north of the Elmendorf Moraine (LF04, SD15, and WP14) and three source areas located south of Ship Creek (LF02, LF03, SD73). LF04 is an old landfill used from 1945 to 1957. SD15 and WP14 are old POL sludge disposal sites. LF02 and LF03 are old abandoned landfills. SD73 consists of surface drains in a building once used as a rock testing laboratory and a surface disposal area next to the building. Due to minimal contamination at LF03 and SD73, these sites were designated as NFA sites in the OU6 ROD (USAF, 1997h). In FY96, source area SS19 was moved to OU6 from OU7.

²See footnote 1 above.

During the FY95 field season, an expedited response action to remove pesticide contaminated soil was completed at SS19. As a result of the successful completion of the expedited response action, the agencies have agreed this source qualifies as a no further action (NFA) site. Because the contaminated soils at SS19 have been satisfactorily removed, and the residual risk is at an acceptable level, no further action is required.

The OU6 ROD was signed in January 1997, and the major components of the selected remedies include:

- Groundwater at LF02, LF04, SD15, and WP14 will be included in the basewide monitoring program and sampled semiannually (twice a year).
- At LF04 and WP14, recoverable quantities of free product found on top of the water table will be removed during groundwater monitoring events.
- Conduct annual debris removal on the beach at LF04.
- Groundwater at SD15 will be treated by a high-vacuum extraction (HVE) process. Free product will also be recovered using this process.
- Implement institutional controls at LF02, LF04, SD15, and WP14 to prohibit the use of the shallow aquifer and/or designate the areas as “restrictive use area” to prohibit the construction of any sort of manned facility, such as an office building or residence.
- Landfill debris on top of or protruding from the ground surface at LF02 will be removed and a limited cover will be applied in three areas with elevated lead concentrations to eliminate the exposure pathway.

3.0 CURRENT STATUS

This section describes the current status of the selected remedies as required by the RODs for OUs 1-6. RODs have been signed and response actions are in progress at all Elmendorf OUs. RODs and remedial action (RA) reports contain the details and the status of the remedial action(s), including a discussion of the applicable or relevant and appropriate requirements (ARARs) for each OU. ARARs were not reevaluated in this review because a re-evaluation is not required at sites where response actions are ongoing. However, the project team did evaluate whether any cleanup standards or requirements for site-related COCs at Elmendorf had been changed. No such changes were found which might have called into question the protectiveness of the remedies. This evaluation provided further assurance that the selected remedies remain protective. Since several RODs require groundwater monitoring and institutional controls, a basewide approach for implementing these remedies has been established.

3.1 Basewide Groundwater. A basewide groundwater monitoring program has been established to ensure that both OU-specific and basewide groundwater issues are addressed and that the remedies taken together are and can be expected to remain protective. Monitoring

results are evaluated annually and the program is modified as appropriate to ensure the program remains comprehensive and protective.

The shallow aquifer in the outwash plain alluvium is not used for drinking water purposes and institutional controls have been established to ensure that it is not developed until groundwater attains cleanup levels. With ongoing natural attenuation and the implementation of remedial actions, the shallow aquifer is expected to be restored and available for beneficial use within timeframes predicted in each ROD.

The majority of the shallow aquifer discharges into wetlands adjacent to Ship Creek. Monthly surface water monitoring of Ship Creek was accomplished from 1994 to 1996 to evaluate its condition and no evidence of any COCs were found. Therefore, the sampling frequency of Ship Creek has been reduced to twice yearly in conjunction with OU5 groundwater sampling.

Modeling for the shallow aquifer was conducted in 1994, 1997, and the spring of 1998 to evaluate contaminant migration and the potential for impacts to downgradient receptors. Modeling concluded that the contaminant plumes are not migrating far from the source areas or reaching downgradient receptors.

Natural attenuation is being monitored as a component of several remedies selected for the base. Data currently suggests natural attenuation is occurring at rates expected to achieve cleanup goals within timeframes predicted in each ROD.

The basewide groundwater monitoring program continues to demonstrate that natural attenuation taken together with other selected remedies are currently, and are expected to remain, protective of human health and the environment. Groundwater from a basewide perspective will be addressed in future periodic reviews and, if necessary, further actions will be evaluated.

3.2 Institutional Controls. Institutional controls have been established to implement remedies selected in the RODs for OUs 1, 2, 4, 5, and 6. The purpose of these institutional controls is to prevent exposure to contaminated media. The specific controls range from fences around contaminated sites, to specific land use restrictions, to the prohibition of the use of groundwater from the shallow aquifer. The institutional controls have been incorporated into and are described in detail in the Base General Plan³ (USAF, 1997f) and the Environmental Restoration Program's Management Action Plan (MAP) (USAF, 1998f). Plates 1 and 2 in section 2.0 of the MAP outline the basewide and site-specific institutional controls. The Elmendorf Environmental Protection Committee (EPC) is responsible for overseeing compliance with these institutional controls. The implementation and effectiveness of these institutional controls are reviewed at least annually by the Elmendorf's Environmental Flight and any proposed changes affecting these controls are forwarded to EPA and ADEC for review.

The following procedures have been adopted to ensure compliance with institutional controls.

- **New or Proposed Facilities.** For proposed facility siting and/or new construction, the institutional controls are enforced through Base Development (3 CES/CECD) and the

³ Formerly called Base Comprehensive Plan.

Environmental Planning element (3 CES/CEVP). 3 CES/CECD has incorporated the institutional controls into the Base General Plan. When there is a proposed project on base, 3 CES/CECD reviews the Base General Plan to determine if the project is in an area affected by institutional controls. If the project is within an area where institutional controls are in place, then the project is forwarded to the Environmental Planning element for review. Environmental Planning, in consultation with Environmental Restoration (3 CES/CEVR), reviews the project to determine if the project complies with specific institutional controls. If the project conflicts with the institutional control, then the project is disapproved.

- **Work Orders (AF Form 332) and Base Civil Engineer's (BCE) Work Clearance Request.** All AF Form 332s and BCE Work Clearance Requests (3rd Wing Form 3) are routed through the Environmental Flight (3 CES/CEV) for review. Environmental Planning reviews AF Form 332s to ensure compliance with all environmental requirements including institutional controls. If an activity is proposed in an area affected by institutional controls, then Environmental Restoration is consulted to determine if the activity complies with specific institutional controls. If the activity conflicts with the institutional control, then the activity is disapproved. All BCE Work Clearance Requests are routed through Environmental Restoration for review because these requests normally involve some type of excavation. Environmental Restoration reviews each request and conducts site visits as appropriate to ensure institutional controls and other restrictions are enforced.
- **Real Estate Transactions.** The Real Estate office (3 CES/CERR) is responsible for ensuring institutional controls are incorporated into all real estate instruments such as easements, licensees, right-of-entry, and permits. Tenants, permittees, etc. are required to provide an annual certification of compliance with institutional controls. For new real estate transactions and renewals of real estate instruments, Air Force regulations require the Environmental Flight to perform an Environmental Baseline Survey (EBS). Land use and other restrictions are incorporated into the EBS and the real estate instrument to ensure institutional controls are enforced.

3.3 Operable Unit 1. Response actions at OU1 are ongoing. All remedial actions are operational and functional, as documented in the OU1 RA report (USAF, 1998a).

All required institutional controls have been established and incorporated in the Base General Plan and the MAP, and the Air Force continues to administer the institutional controls. Monitoring wells are in good condition and are visited at least every six months. Site conditions and land use are consistent with the OU1 ROD requirements and remain protective, based on evaluation of current monitoring data and trends, and the most recent joint inspection conducted by the USAF, EPA and ADEC project managers on April 9, 1998.

Groundwater monitoring is being conducted semi-annually as part of the basewide groundwater monitoring program. Two of the OU1 COCs, ethylene dibromide (EDB) and vinyl chloride, were below detection limits and cleanup goals during the 1996 and 1997 sampling events. Groundwater monitoring results indicate that two other COCs, manganese and trichloroethylene

(TCE), are migrating downgradient; however, the levels decrease with distance and are not expected to impact downgradient receptors. The results are consistent with natural attenuation. As there are no drinking water wells within or downgradient from OU1, there is no evidence at this time of a current or future threat to human health or the environment. Additional efforts are being made to understand the source and significance of manganese in OU1 and throughout the Base. This evaluation could conceivably lead to modification of the cleanup goals in the future.

Long-term operation (LTO) and maintenance of the remedy will continue until groundwater cleanup goals are achieved. Current estimates (based on evaluation of groundwater monitoring and modeling results) indicate groundwater throughout OU1 is expected to achieve cleanup goals within the next six years (year 2004). This timeframe is consistent with the original estimates in the ROD.

The OU1 remedies remain protective of human health and the environment and are functioning as designed. OU1 remedies will be addressed in future periodic reviews and, if necessary, further actions will be evaluated.

3.4 Operable Unit 2. All remedial actions are operational and functional, as documented in the OU2 RA report (USAF, 1998b). The source removal (tank, pipeline, and soil) was successfully completed in 1996. The removal of the most highly contaminated sediments, closure of the tanks, and removal of a major contaminant transport mechanism (the wood stave pipe downgradient from Tank 601) represents a major reduction in potential risk to human health and the environment. Institutional controls have been established and are being maintained to prevent exposure until cleanup goals are attained throughout OU2.

Site conditions and land use are consistent with the OU2 ROD requirements and remain protective, based on evaluation of current monitoring data and trends, and the most recent joint inspection conducted by the USAF, EPA and ADEC project managers on April 9, 1998.

The groundwater treatment system and monitoring program are in place, operational and functional. LTO and maintenance of the treatment system is continuing in accordance with the operation and maintenance (O&M) plan (USAF, 1995c), and will continue until such time as the performance criteria discussed in the RA report are met. Overall, the data collected since the 1993 remedial investigation (USAF, 1994b) suggests that a very limited amount of free product remains at ST41. Based upon the 1997 review of the treatment system and evaluation of the 1997-98 monitoring data as part of this review, USAF, EPA and ADEC project managers expect remedial action objectives for free product recovery to be met in February 1999, at which time the system will be shut down. After system shut down, it is expected that natural attenuation will be capable of addressing the remaining groundwater contamination, as predicted in the ROD.

Surface water and groundwater data verify dissolved contamination is not migrating and natural attenuation is occurring. It is estimated that all cleanup goals will be attained by the year 2016. The OU2 remedies remain protective of human health and the environment and are functioning as designed. OU2 remedies will be addressed in future periodic reviews and, if necessary, further actions will be evaluated.

3.5 Operable Unit 3. Response actions at OU3 are underway and are approximately 95 percent complete. Excavation of the PCB-contaminated soils at SS21 commenced on April 27, 1998 and over the next four months approximately 980 tons of PCB-contaminated soil was excavated and shipped to an EPA-approved disposal facility in the Lower 48. Sampling was performed upon completion of the excavation of the PCB-contaminated soil and results confirmed cleanup goals outlined in the ROD were achieved. Upon completion of excavation activities, the area was backfilled and graded to the original elevations, and then landscaped. The temporary fence, which was installed in 1996 to restrict access to the site, has been removed. The only outstanding issue remaining, is the receipt of the certification of disposal from the EPA-approved disposal facility.

The selected remedy for OU3 is protective and compliant with ARARs. All remedial activities at SS21 were accomplished in accordance with the remedial design (USAF, 1997d). Based upon confirmation samples obtained at the conclusion of the SS21 remedial action, PCB contamination remaining on site is less than 0.6 ppm, well below the ARARs outlined in the ROD. The successful completion of the SS21 remedial action allows for unlimited use and unrestricted exposure to the site. No future five-year reviews of OU3 will be conducted because the remedial action was successfully completed as planned.

3.6 Operable Unit 4. All remedial actions are operational and functional, as documented in the OU4 RA report (USAF, 1998g). Bioventing and monitoring are continuing at all OU4 locations in accordance with the bioventing performance and monitoring plan (USAF, 1996b). For shallow soils, sufficient intrinsic remediation has occurred such that cleanup goals have been reached at SS10 and SD25 (Hangar 11). No further monitoring of shallow soils is being done at these sites. Institutional controls have been established and are being maintained to prevent exposure until cleanup goals are attained throughout OU4.

Bioventing systems and monitoring wells have been inspected and are in good condition. One groundwater monitoring well may need to be reconfigured to a flush mount to accommodate flight operations.

Based on review and evaluation of 1997 soil and 1997 and 1998 groundwater monitoring data, COCs in deep soils still exceed cleanup levels for fuel-related constituents (DRO, GRO, and jet fuel). Also, groundwater in the shallow aquifer still exceeds cleanup goals for benzene, ethylbenzene, toluene and certain waste solvents. Summaries of monitoring data and information are available in the 1997 Groundwater Monitoring Annual Report (USAF, 1998e). Due to current land use and institutional controls, there is no human exposure to the groundwater (or contaminated soils). Response actions at OU4 are expected to continue for another 11-12 years to address groundwater, based on site data and current estimates of the time to remediation documented in the 1997 Groundwater Monitoring Annual Report. It is anticipated that the deeper soil at FT23 and SD25 (Hangar 11) will attain clean-up levels and the bioventing systems will be shut down in approximately two years. Closure of the SS10 bioventing system is scheduled for 2003.

The OU4 remedies remain protective of human health and the environment and are functioning as designed. OU4 remedies will be addressed in future periodic reviews and, if necessary, further actions will be evaluated.

3.7 Operable Unit 5. All remedial actions are operational and functional, as documented in the OU5 RA report (USAF, 1998c). The ST37 wetland system is operational and the O&M manual is being written. Groundwater monitoring and sediment sampling is continuing at OU5 and upgradient locations in accordance with the Environmental Monitoring Plan (USAF, 1997c). The ST37 wetland system and all monitoring wells have been inspected and are in good condition. Institutional controls have been established and are being maintained to prevent exposure until cleanup goals are attained throughout OU5.

Site conditions and land use are consistent with the OU5 ROD requirements and remain protective, based on evaluation of current monitoring data and trends, and the most recent joint inspection conducted by the USAF, EPA and ADEC project managers on February 20, 1998.

Shallow contaminated soils at the four seep locations were removed during construction of the wetland system. These soils were placed in a land-farm and are awaiting confirmation sampling to ensure that cleanup goals have been reached. No other monitoring of shallow soils is being done at these sites.

COCs in sediments at ST37 and groundwater in the shallow aquifer still exceed cleanup goals. Summaries of monitoring information are available in the 1997 Groundwater Monitoring Annual Report. Due to current land use and institutional controls, there is no human and ecological exposure to the groundwater. Response actions at OU5 are ongoing and are expected to continue for another 23 years, based on current estimates of the time to remediation documented in the 1997 Groundwater Monitoring Annual Report.

The OU5 remedies remain protective of human health and the environment and are functioning as designed. OU5 remedies will be addressed in future periodic reviews and, if necessary, further actions will be evaluated.

3.8 Operable Unit 6. All remedial actions are operational and functional, as documented in the OU6 RA report (USAF, 1998d). Groundwater monitoring is continuing at all OU6 locations in accordance with the Environmental Monitoring Plan. Institutional controls have been established to prevent development or human exposure to contamination at source areas. Site conditions and land use are consistent with the OU6 ROD requirements and remain protective, based on evaluation of current monitoring data and trends, and the most recent joint inspection conducted by the USAF, EPA and ADEC project managers on April 9, 1998. The OU6 treatment systems and all monitoring wells have been inspected and are in good condition.

A HVE system constructed in 1996 is being used to treat soil and groundwater contamination at SD15. Debris and concrete pads were removed and disposed of at a local land reclamation area. Shallow contaminated soils were excavated, taken to Alaska Soil Recycling, and recycled in a low temperature thermal desorption unit. After treatment, the soils were returned to SD15 and

used as backfill material. The operation of the HVE system is continuing in accordance with the SD15 O&M manual (USAF, 1997b).

In the fall of 1996, surface debris removal was conducted throughout LF02. Soil covers were constructed over three areas to minimize potential human exposure to lead contaminated soils in these areas.

At LF04 initial removal of debris (beach sweeps) on the beach was conducted in the summer of 1997 to determine the best method of debris removal for future efforts (USAF, 1998h). Beach sweeps will be conducted annually, as long as the landfill is subject to tidal erosion. The perched aquifer at SD15 and the shallow aquifer in the outwash plain still exceed cleanup goals. Summaries of monitoring information are available in the 1997 Groundwater Monitoring Annual Report. Due to current land use and institutional controls, there is no human exposure to the groundwater. Response actions at OU6 are ongoing and are expected to continue for another 4 - 22 years, based on estimates of the time to remediation documented in the OU6 ROD.

The OU6 remedies remain protective of human health and the environment and are functioning as designed. OU6 remedies will be addressed in future periodic reviews and, if necessary, further actions will be evaluated.

4.0 AREAS OF NON-COMPLIANCE

No areas of non-compliance were identified during this review.

5.0 RECOMMENDATIONS

All remedies remain protective of human health and the environment. The remedial systems are operating and functioning as designed and no modifications are required.

6.0 NEXT FIVE-YEAR REVIEW

Future five-year reviews are necessary because contamination remains above levels that allow for unrestricted use and/or unlimited exposure at OUs 1, 2, 4, 5, and 6. The next five-year review will be completed by August 2003.

7.0 CERTIFICATION OF PROTECTIVENESS

The Air Force certifies that the remedies selected for this site remains protective of human health and the environment.

STEPHEN D. BROWN, Colonel, USAF
Vice Commander

Date

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